

Improving Freeform Manufacturing using a Unique Deflectometry Enclosure, Phase I

Completed Technology Project (2018 - 2019)



Project Introduction

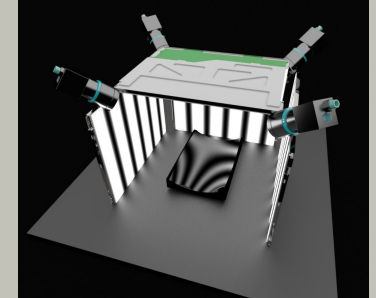
NASA has identified freeform optics as an integral part of their future optical systems. Reducing the cost of freeforms will be crucial in accelerating the integration of freeforms into cost-sensitive NASA optical systems. One method to reduce cost is to reduce the metrology time needed to characterize the freeforms. This is especially true when measuring the mid-spatial frequency errors induced during the manufacturing process. Current methods are tactile measurement devices such as a coordinate measurement machine and profilometers. These metrology methods slow the manufacturing process and therefore increase cost. The goal of this NASA Phase 1 SBIR is to develop and investigate a unique deflectometry enclosure to improve efficiency of the manufacturing of freeform optics. This proposed innovation is a multi-camera multi-monitor deflectometry system that can be integrated into manufacturing. It would increase efficiency of the freeform manufacturing process by greatly reducing the time to measure the mid-spatial frequency errors of the freeform part and therefore would reduce the time and cost of freeform manufacturing.

Anticipated Benefits

Freeform based optical systems provide better optical performance in smaller footprint. NASA applications include: **Exo-planet imaging systems** - Freeform optics would improve performance with fewer optics in a smaller footprint. **LUVUOIR Ultraviolet Multi Object Spectrograph** - Operating in the UV would require fewer optics in as smaller package. **Origins Space Telescope (OST)** - This telescope operating in the infrared High performance freeform optics would solve the requirement of

Freeforms: Freeform optics are quickly becoming part of many commercial and military optical systems. Many optical designers are starting to use freeform optics to achieve optical performance (less aberrations), lighter weight optical systems through a reduced number of components, and an increased ability to go off axis with smaller and tighter packages. Examples of commercial uses of freeforms include:

*Heads-up displays, *Compact imaging systems, *Augmented and Virtual reality display systems



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Table of Contents

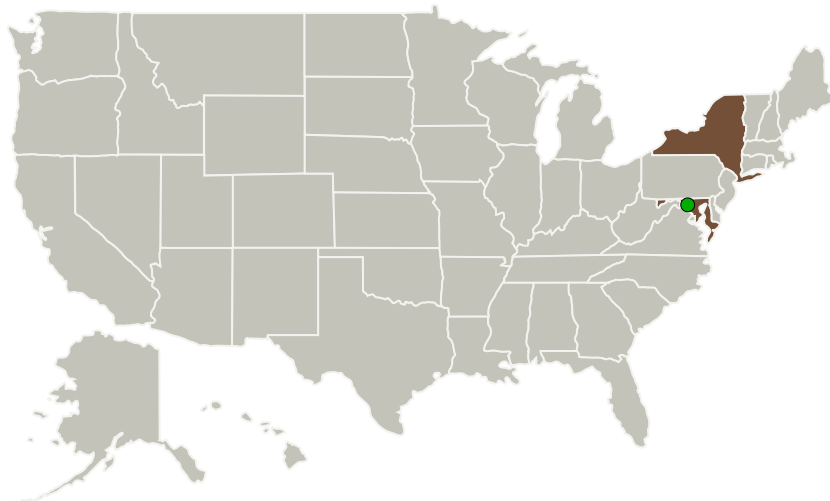
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Optimax Systems, Inc.	Lead Organization	Industry	Ontario, New York
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland	New York
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Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141825>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Optimax Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

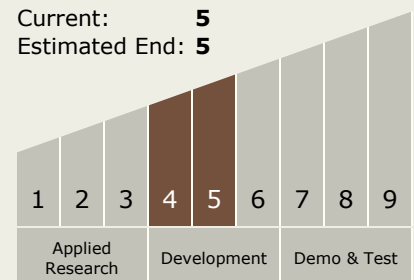
Carlos Torrez

Principal Investigator:

Todd Blalock

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**

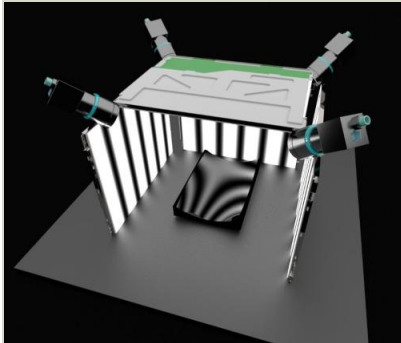


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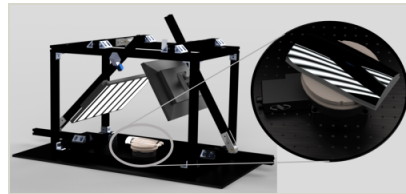


Images



Briefing Chart Image

Improving Freeform Manufacturing using a Unique Deflectometry Enclosure, Phase I
(<https://techport.nasa.gov/image/136571>)



Final Summary Chart Image

Improving Freeform Manufacturing using a Unique Deflectometry Enclosure, Phase I
(<https://techport.nasa.gov/image/132235>)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.3 Optical Components

Target Destinations

Earth, Outside the Solar System